ACTIVE SEAL ASSEMBLIES FOR SOUND ISOLATION

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application relates to and claims priority to U.S. Provisional Application No. 60/552,781 entitled "Active Seal Assemblies" and filed on Mar. 12, 2004, the disclosure of which is incorporated by reference herein in their entirety.

BACKGROUND

[0002] This disclosure relates to seals, and more particularly, to active seal assemblies for sound isolation.

[0003] Current methods and assemblies for sealing opposing surfaces such as doors and trunk lids, for example, include the use of flexible elastic membranes and structures that sealingly compress upon pressing contact of the opposing surfaces. Typical materials include various forms of elastomers, e.g., foams and solids, that are formed into structures having solid and/or hollow cross sectional structures. The geometries of the cross sections are varied and may range from circular forms to irregular forms having multiple slots and extending vanes.

[0004] Sealing assemblies are typically utilized for sound and/or fluid management. The seals generally are exposed to a variety of conditions. For example, for vehicle applications, door seals generally are exposed to a wide range of temperatures as well as environmental conditions such as rain, snow, sun humidity conditions, and the like. Current materials utilized for automotive seals are passive. That is, other than innate changes in modulus of the seal material due to environmental stimuli, the stiffness and cross sectional geometries of the seal assemblies cannot be remotely changed or controlled.

[0005] Accordingly, it is desirable to have active seal assemblies that can be controlled and remotely changed to provide sound isolation.

BRIEF SUMMARY

[0006] Disclosed herein are active seal assemblies for sound isolation and methods of use. In one embodiment, the active seal assembly comprises a flexible hollow body comprising an interior wall defining a first chamber and a second chamber; a sensor disposed in an exterior wall of the body and in operative communication with a controller, wherein the sensor is adapted to detect an amplitude and a phase of a noise vibration and forward a signal corresponding to the amplitude and the phase to the controller; and an active material disposed within the interior wall and in operative communication with the controller, wherein the active material is adapted to cancel the signal corresponding to the amplitude and the phase in response to an activation signal from the controller.

[0007] In another embodiment, the active seal assembly comprises a flexible hollow body comprising an interior wall defining a first chamber and a second chamber; a normal force sensor disposed in an exterior wall of the body and in operative communication with a controller, wherein the normal force sensor is adapted to detect planar waves and forward a signal to the controller, wherein the controller is adapted to average the amplitudes and frequencies associated with planar waves; and an active material disposed within the interior wall and in operative communication with the controller, wherein the active material is adapted to absorb the planar waves in response to an activation signal from the controller.

[0008] In yet another embodiment, the active seal assembly comprises a flexible hollow body defining an interior wall region; a shear force sensor disposed in an exterior wall of the body and in operative communication with a controller, wherein the shear force sensor is adapted to detect a noise vibration and forward a signal to the controller; and a plurality of planar membranes comprising an active material in operative communication with the controller, wherein the plurality of planar membranes are disposed in the interior wall region and are generally parallel to a base portion of the flexible hollow body, wherein the active material is adapted to cancel the signal in response to an activation signal from the controller.

[0009] In yet still another embodiment, the active seal assembly comprises a flexible hollow body defining an interior wall region; a shear force sensor disposed in an exterior wall of the body and in operative communication with a controller, wherein the shear force sensor is adapted to detect a noise vibration and forward a signal to the controller; and a plurality of planar membranes disposed in the interior wall region and are generally parallel to a base portion of the flexible hollow body; and an active material fluid intermediate each one of the plurality of planar membranes in operative communication with the controller, wherein the active material is adapted to cancel the signal in response to an activation signal from the controller.

[0010] The above described and other features are exemplified by the following figures and detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Referring now to the figures, which are exemplary embodiments and wherein like elements are numbered alike:

[0012] **FIG. 1** is a cross sectional view of a active seal assembly adapted to provide responsive sound cancellation;

[0013] **FIG. 2** is a partial perspective view the active seal assembly of **FIG. 1**;

[0014] **FIG. 3** is a cross sectional view of a active seal assembly adapted to provide dissipative sound cancellation; and

[0015] **FIG. 4** is a cross sectional view of a active seal assembly adapted to provide dissipative sound cancellation in accordance with another embodiment.

DETAILED DESCRIPTION

[0016] Disclosed herein are active sealing assemblies and methods of use, wherein the shape and/or modulus properties of the active seals employed in the active sealing assemblies can be remotely activated and/or controlled to selectively provide sound isolation and/or noise cancellation. Although reference will be made herein to automotive applications, it is contemplated that the active seals for sound isolation can be employed for various interfaces between opposing surfaces such as refrigerator doors, windows, and the like so as to mitigate and/or cancel unwanted